14.4Kbps V.32bis INTERNAL MODEM

The Ultimate in High-Performance

Product Code:

M1440IW
(Internal Model)

M1440EW
(External Model)

Using the Boca Research 14.4Kbps MODEM manual.
This manual provides installation and operating instructions for the Boca **14.4Kbps MODEM.** The manual assumes the user has basic computer skills and is familiar with personal computers. Its primary purpose is to provide physical installation instructions and basic troubleshooting. All sections should be read carefully before beginning any installation procedures. Our customer support experience has shown that many costly and time-consuming calls to our technical support staff can be avoided with closer attention to the information provided here. **In addition to following the instructions provided in this manual, you will also need to consult the documentation supplied with your communications software.**

IMPORTANT NOTICE

FCC Requirements
The Federal Communications Commission (FCC) restricts the way you can use modems. Read the FCC compliance statement found in Appendix D of this manual.

Telephone Company Requirements
Some telephone companies require notification when any electronic communications equipment is connected to the telephone lines. Contact the phone company before connecting your modem to the telephone line and provide them with the following information:

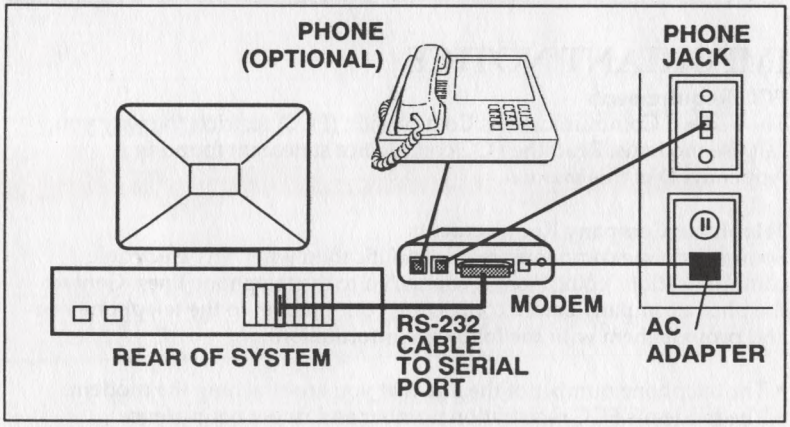
- The telephone number of the line that you are attaching the modem.
- The modem's FCC registration number and ringer equivalence number. These numbers are printed on the FCC label which appears on the main chip in the center of the internal modem board, or on the underside of the external version of the modem.

You can connect the modem to various types of telephone jacks. The acceptable phone jack types are RJ-11, RJ-12, RJ-13, RJ-41S, and RJ-45S. Most homes and businesses use one of these jacks. If your phone system does not have a modular jack, you can purchase an adapter to convert your jack into an RJ-11C jack. Adapters may be purchased from any local phone or electronics store.

Quick Start!

FOR THE EXTERNAL MODEL

If you are familiar with personal computers and modems, you may follow the diagram below to quickly connect the 14.4Kbps Modem to your system. Make all necessary connections as shown below.

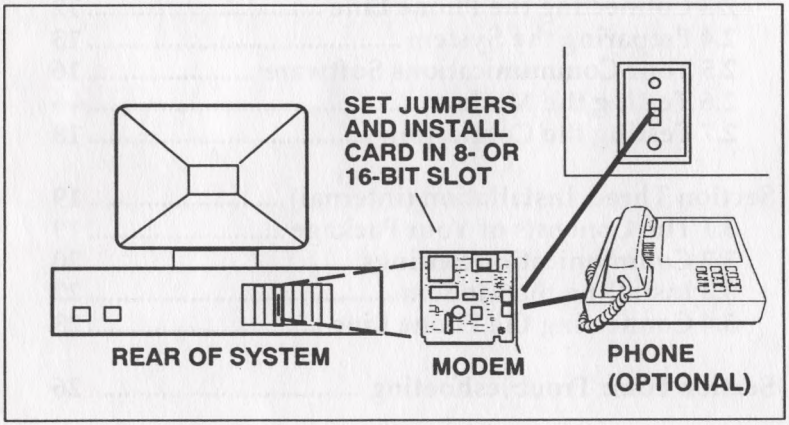


To verify line connection, lift your telephone receiver to check for a dial tone. After hearing the tone, power on your computer, load your communication software. Most communication programs when started are in command mode. Command mode is used for typing AT commands to the modem. If you do not hear a dial tone, see Section Four: Troubleshooting.

Quick Start!

FOR THE INTERNAL MODEL

If you are familiar with personal computers and modems, you may follow the diagram below to quickly connect the 14.4Kbps Modem to your system. Make all necessary connections as shown below.



To verify line connection, lift your telephone receiver to check for a dial tone. After hearing the tone, power on your computer, load your communication software. Most communication programs when started are in command mode. Command mode is used for typing AT commands to the modem. If you do not hear a dial tone, see Section Four: Troubleshooting.

Contents

Quick Start 4

Section One: Introduction 7

Section Two: Installation (external) 10
2.1 The Contents of Your Package 10
2.2 Operational Requirements 11
2.3 Connecting the Phone Line 12
2.4 Preparing the System 13
2.5 Your Communications Software 16
2.6 Testing the Modem 16
2.7 Testing the Connection 18

Section Three: Installation (internal) 19
3.1 The Contents of Your Package 19
3.2 Communication Settings 20
3.3 Installing the Modem 22
3.4 Connecting the Phone Line 23

Section Four: Troubleshooting 26

Appendix A: Command and Protocol Reference 31
Appendix B: Hardware Diagnostics 35
Appendix C: Technical Specifications 40
Appendix D: Compliance Information 41
Appendix E: Warranty Information 45
Appendix F: Servicing Your Product 46
Command Quick Reference 49
Glossary 55

Introduction

The 14.4Kbps modem (internal or external version) combines high-speed data, modem, and fax capability on a single device. It features V.32bis, which provides high-speed data transmission plus support for V.42bis (error correction) and MNP5 (data compression).

Features

- Data transmission rates of 14.4K, 12K, 9600, 7200, 4800, 2400, 1200, or 300bps.
- 100% data compatibility with the Hayes 'AT' command set.
- Programmable speaker volume control
- Automatic voice and data switching.
- Auto-speed sensing.
- V.32bis, V.42bis, and MNP5 are supported as well as V.42 and MNP 2-4 error correction, offering throughput speed of 57,600 bps.
- Group III send and receive fax capability with support for Class 1 and Class 2 fax commands.
- Supports 100 x 196 high resolution and 100 x 98 low resolution.
- Supports high-level data-link control framing.
- Communication ports selectable as COM1, 2, 3, or 4 using interrupts 3, 4, 5, or 7 (**INTERNAL ONLY**).

The Appendix features a discussion of standard and extended 'AT' commands and S-Registers as well as high-level protocols.

Installation Hints

Your BOCAMODEM has been pre-set at the factory for optimum performance. All defaults are set to allow the modem to negotiate the best possible connection with highest quality, data compression, and error correction. Because of these factory defaults, the suggested initialization (INIT) string is:

ATZ

You should change the INIT string in all of your software packages to this INIT string.

If you want to custom configure your stored profiles, we suggest that you always start out with an **AT&F&C1&D2&R1** before customizing other commands. This string will reset the modem to the factory defaults as well as reset some other basic settings. If you experience a decrease in modem performance after modifying settings, send the INIT string above (AT&F...&R1) to the modem.

If you experience a data connection difficulty with a U.S. Robotics HST Dual Standard Modem on a BBS, the following should allow you to connect. First, set the modem software to a DTE speed of 9600.

ATN0	**Follows the S37 register**
ATS37=9	**Forces modem to connect at 9600bps**
AT&Q6	**Normal High-Speed Asynchronous Communication**

HOW THIS MANUAL IS ORGANIZED

Quick Start. If you are familiar with modem operations, this abbreviated procedure provides a short cut for connecting the Boca 14.4Kbps Modem. Otherwise, read Section Two or Three before continuing.

Section One: Introduction. An overview of the features of the Boca 14.4Kbps Modem.

Section Two and Three: Installation. These sections provide communication settings (**internal** only), a diagram of the 14.4Kbps Modem board or external unit, physical installation instructions (including how to connect the phone line), and procedures for testing the connection.

Section Four: Troubleshooting. This provides a description of the most common problems which may be encountered during installation and operation along with possible solutions.

Appendices. These include:

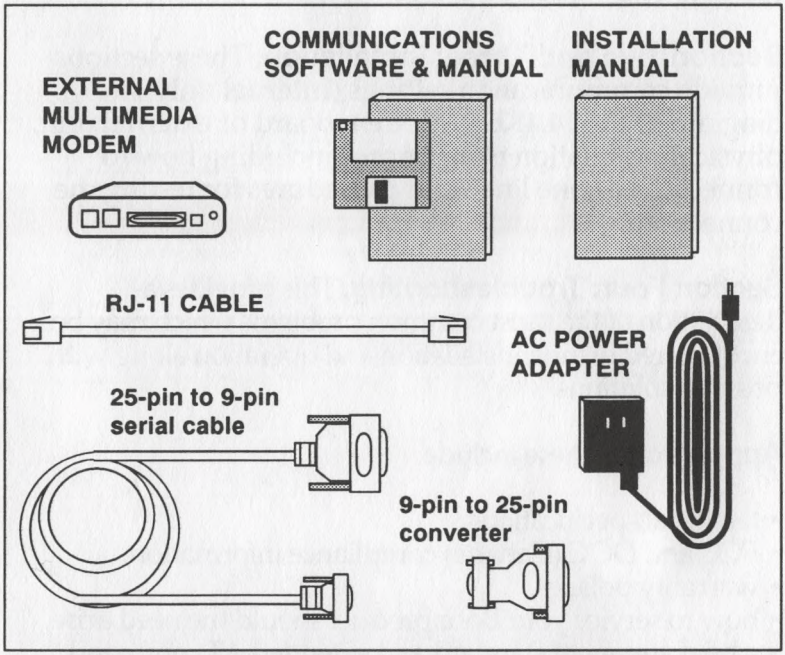
- technical specifications,
- FCC and DOC (Canada) compliance information,
- warranty policies,
- how to service your Boca product should the need arise,
- a brief survey of standard and extended AT command sets, S-registers, and high-level protocols,
- hardware diagnostics
- glossary

Section Two: Installation (External Model)

This section explains how to connect the Boca Research 14.4Kbps Modem to your computer.

2.1 The Contents of Your Package

Verify that your modem package contains the following items:



If any items are missing or damaged, contact the vendor from whom you purchased the modem for assistance.

2.2 Operational Requirements

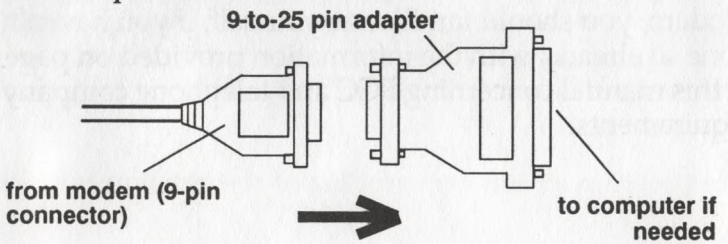
The 14.4Kbps Modem has few requirements and is easy to use. Be sure to read the information on page 3 about connecting to the phone company. In addition, note the following:

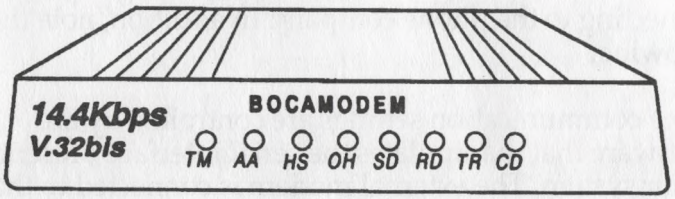
- The communication settings are controlled by the software that manipulates the serial interface present in your system. The external modem is connected to that interface.

- Operating the 14.4Kbps Modem with a computer requires communication software, either as a stand-alone product as included here, or as part of an application program.

- The 14.4Kbps Modem takes a DB-25 (25-pin male connector), but computer equipment varies. Check the serial ports at the rear of your system.

- The 14.4K bps Modem uses an existing serial port on the back panel of your computer. It can be a 9-pin or 25-pin D-shaped connector. Use the adapter to connect the 9-pin Modem cable to the back panel if your computer has a 25-pin connector.



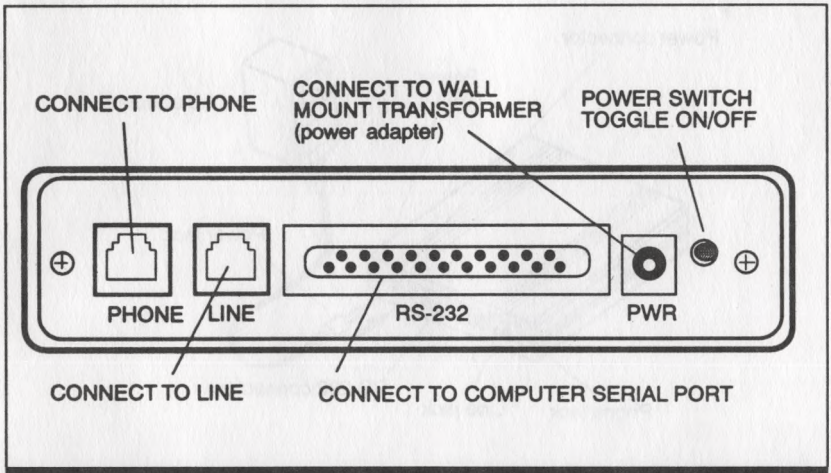


FRONT VIEW: BOCA 14.4KBPS MODEM

2.3 Connecting the Phone Line

An RJ-11 cable is provided with the purchase of your 14.4Kbps Modem. This section contains information you will need before you connect the telephones line to the 14.4Kbps Modem and explains how to make the proper connections from the 14.4Kbps Modem to your telephone line.

Before you connect the telephone line to the 14.4Kbps Modem, you should familiarize yourself, if you haven't done so already, with the information provided on page 3 of this manual concerning FCC and telephone company requirements.



REAR VIEW: BOCA 14.4KBPS MODEM

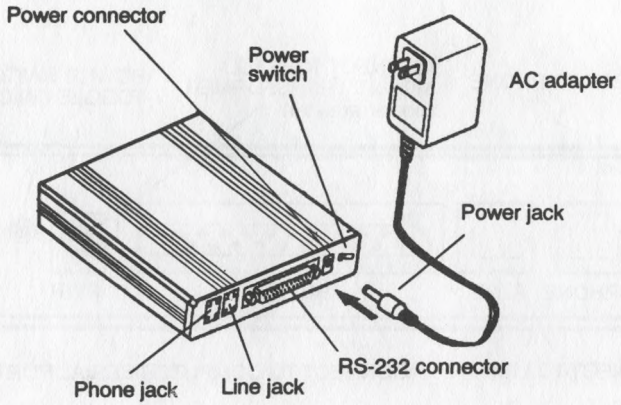
2.4 Preparing the Modem

Follow these simple steps to connect the modem to your computer:

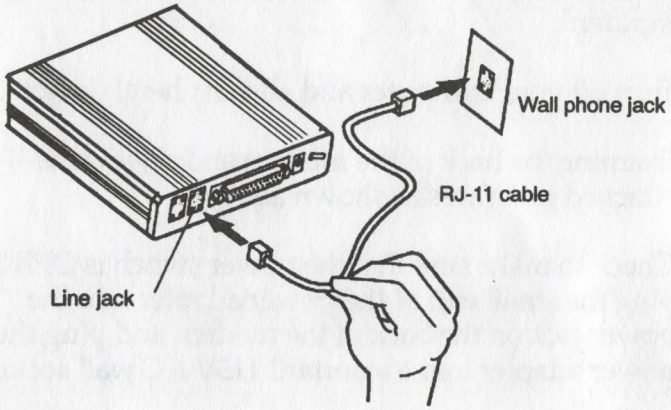
1. Turn off your computer and all peripheral devices.

2. Examine the back of the modem and review the attached interfaces as shown above.

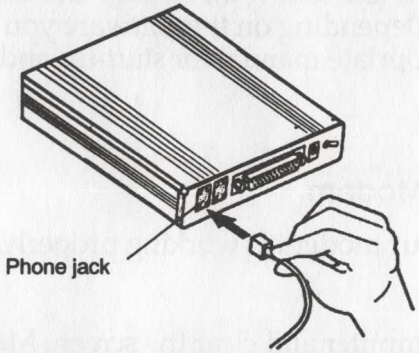
3. Check to make sure that the power switch is OFF. Then plug the small end of the power adapter into the power jack on the back of the modem and plug the power adapter into a standard 115V AC wall socket.



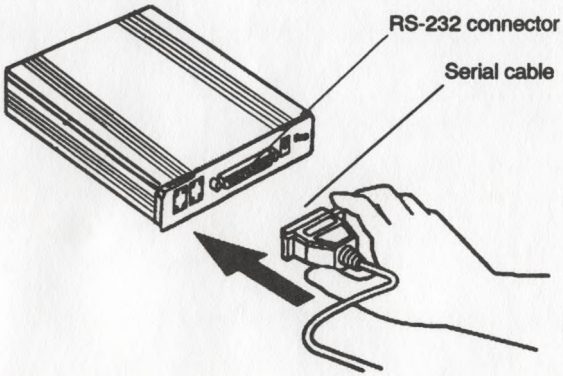
4. Disconnect your present phone cord from the wall jack. Plug the end of the phone cord that came with the modem into the wall jack, and the other end into the RJ-11 jack at the rear of the modem marked **LINE**.



If you want to keep your telephone connected for conventional calls, plug its cord into the other jack at the rear of the modem labeled **PHONE**.



5. Lastly, connect the modem to the computer's serial port with the serial cable. The modem is now ready to be tested and operated.



2.5 Install Your Communications Software

Install your software now. When complete, go to the following sections (*2.6 Testing the Modem* and *2.7 Testing the Connection*). Depending on the software you choose, refer to the appropriate manual for start-up and configuration.

2.6 Testing the Modem

To verify that your modem is working properly, follow these steps:

Turn on your computer and clear the screen. Make sure your communications software is loaded and started. The following status indicators will flash accordingly as explained on the following page:

Indicator	Definition	Status
TM	Test Mode	**FLASHES** when modem is in test mode and if any errors are detected.
AA	Auto Answer/	**ON** when in Auto Answer mode and when online with the host modem.
HS	High speed	**ON** when the 14.4Kbps Modem is powered on or communicating with another modem at 4800bps or faster.
OH	Off Hook	**ON** when the 14.4Kbps Modem takes control of the telephone line to establish a data link.
SD	Send Data	**FLASHES** when a data bit is sent to the 14.4Kbps Modem by the computer.
RD	Received Data	**FLASHES** when a data bit is received from the phone line, or when the modem sends result codes to the computer.
TR	Terminal Ready	**ON** when the modem receives a data terminal ready signal from the computer via the RS-232 cable.
CD	Carrier Detect	**ON** when the modem receives a valid data signal (carrier) from a remote modem. Ready for data transmission.

2.7 Testing the Connection

1. Check for a dial tone using the telephone set. If a dial tone is heard, continue with the next step. If you do not hear a dial tone, check the connections you made in 2.4 Preparing the Modem, or refer to *Troubleshooting (Section Four).*

2. Power on the computer.

3. Load your communications software. Most communications programs when started are in command mode. Refer to the program's documentation for additional information.

4. Type in the command **ATZ** followed by **ENTER** and the 14.4Kbps Modem will respond with OK. If the 14.4Kbps Modem does not respond with OK, refer to the Troubleshooting section of this manual.

5. Start your communications software and enter command mode; AT commands typed in at the DOS prompt will result in a "Bad command or file name" message. Type **ATH1** followed by **ENTER** and you should hear a dial tone from the speaker on the modem.

6. Type **ATH** followed by **ENTER** to put the modem on hook. This confirms that the 14.4Kbps Modem has been successfully installed into the computer.

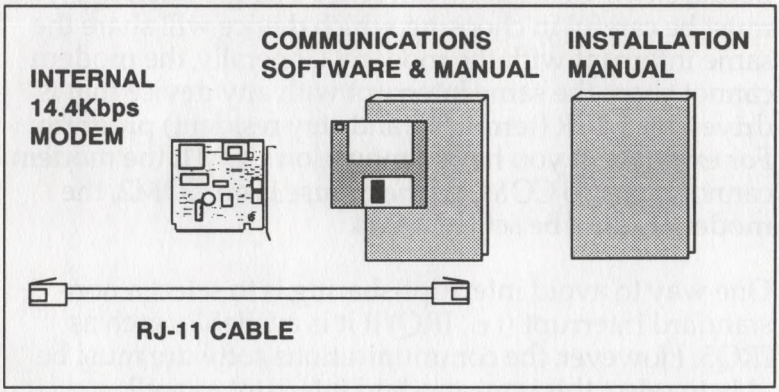
7. Your 14.4Kbps Modem is now ready for use. Proceed now to your communications software and documentation.

Section Three: Installation (Internal Model)

This section explains how to install the Boca Research internal 14.4Kbps Modem in your computer.

3.1 The Contents of Your Package

Verify that your modem package contains the following items:



If any items are missing or damaged, contact the vendor from whom you purchased the modem for assistance

3.2 Communication Settings

The 14.4Kbps Modem can be configured as COM1, COM2, COM3, or COM4. The default setting for the modem is COM1 using IRQ4. The following shows standard COM port and IRQ settings:

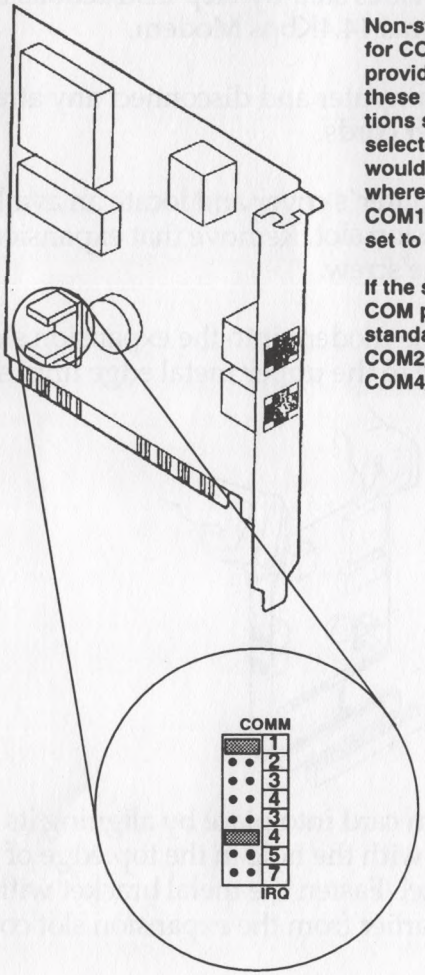
COM1/IRQ4 COM2/IRQ3 COM3/IRQ4 COM4/IRQ3

Because two COM ports can share a single interrupt, you must be careful in choosing which device will share the same interrupt with the modem. Generally, the modem cannot share the same interrupt with any device that is driven by a TSR (terminate and stay resident) program. For example, if you have a mouse on COM1, the modem cannot be set to COM3; if the mouse is on COM2, the modem cannot be set to COM4.

One way to avoid interrupt-sharing is to select a non-standard interrupt (i.e., IRQ) if it is available, such as IRQ5. However, the communications software must be able to select this non-standard interrupt as well.

1. Remove the 14.4Kbps Modem from its anti-static bag, handling it by its edges and metal retaining bracket. Be careful not to touch the edge connector or any components on the modem card.

2. Determine how many serial ports are already installed in your system. Set the jumpers on the modem for the next available port. See the illustration on the next page for assistance in jumper settings.



Non-standard IRQs (e.g., IRQ5 for COM3) can be selected provided IRQ5 is available. In these cases, your communications software must be able to select these IRQs as well. This would be necessary in cases where a mouse is installed on COM1 (IRQ4) and the modem is set to COM3.

If the software can only select COM ports, the IRQs default to standard values: COM1/IRQ4, COM2/IRQ3, COM3/IRQ4, COM4/IRQ3)

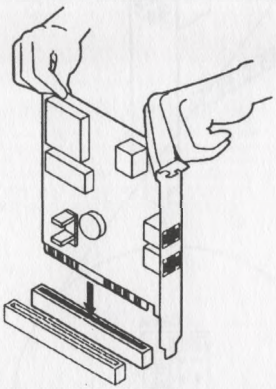
3.3 Installing the 14.4Kbps Modem

This subsection provides step-by-step instructions for installing your internal 14.4Kbps Modem.

1. Power off your computer and disconnect any attached devices and power cords.

2. Remove the computer's cover and locate an available 8- or 16-bit expansion slot. Remove that expansion slot cover and save the screw.

3. Carefully insert the modem into the expansion slot applying pressure to the upper metal edge until snaps into place.



4. Secure the modem card into place by aligning its metal retaining bracket with the hole in the top edge of the system's rear panel. Fasten the metal bracket with the screw removed earlier from the expansion slot cover.

5. Replace the system cover.

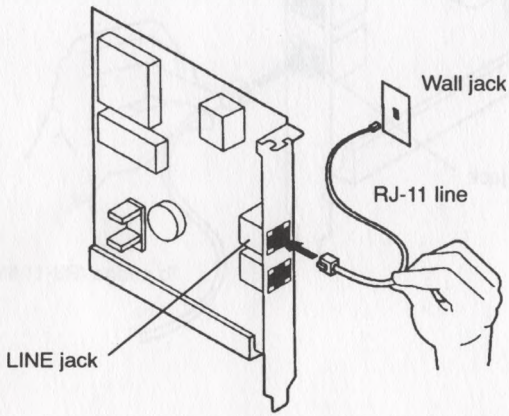
3.4 Connecting the Phone Line

An RJ-11 cable is provided with the purchase of your modem. This sub-section contains information you will need before you connect the telephone line to the modem. It also explains how to make the proper connections from the modem to your telephone line.

Before you connect the telephone line to the modem, you should familiarize yourself, if you haven't done so already, with the information provided on page 3 of this manual concerning FCC and telephone company regulatory requirements.

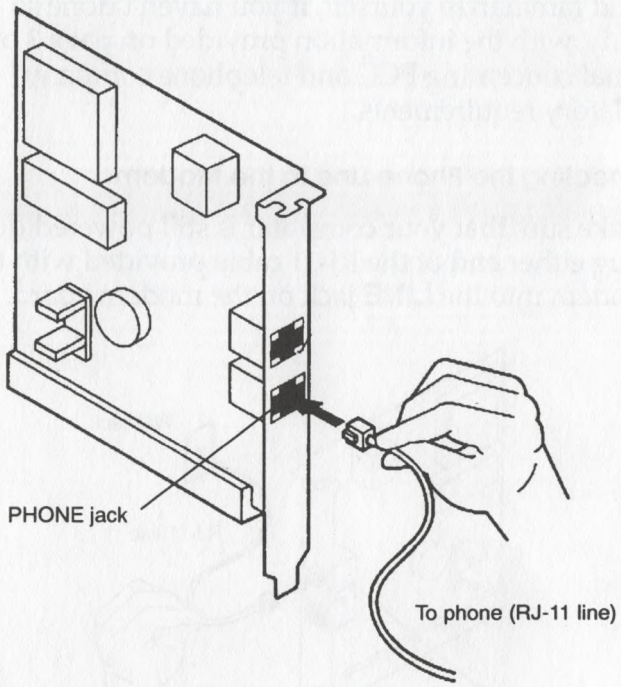
Connecting the Phone Line to the Modem

1. Make sure that your computer is still powered down. Plug either end of the RJ-11 cable provided with the modem into the **LINE** jack on the modem board.



2. If a phone is connected to the telephone wall jack, unplug the phone cable. Then pug the other end of the modem cable into the telephone wall jack.

3. To continue using the phone, connect the phone cable into the **PHONE** jack on the modem board.



Testing the Connection

1. Check for a dial tone. If a dial tone is heard, continue. If you do not hear a dial tone, check the connections your made in the previous subsection, or refer to *Troubleshooting (Section Four).*

2. Power on the computer.

3. Install your communications software (see companion software manual) and place it in command mode. Refer to the program's for additional information.

4. Start your communications software and enter command mode; AT commands typed at the DOS prompt will result in a "Bad Command or File Name" message. Type in **ATZ** followed by ENTER and the modem will respond with OK after a few seconds. If the modem does not respond OK, refer to Troubleshooting (Section Four).

5. Type **ATH1** followed by ENTER and you should hear a dial tone from the modem speaker. To adjust speaker volume, refer to your communications software, or use the **ATL** command.

6. Type **ATH** followed by ENTER to put the modem "on-hook". This confirms that the modem has been successfully installed into the computer.

7. Your 14.4Kbps internal modem is now ready for use.

Section Four: Troubleshooting

This section lists common problems that may be encountered and their possible solutions.

SYMPTOM	POSSIBLE REMEDY
No dial tone.	• Verify that you have cables plugged in correctly as instructed in Section Two or Three. • Connect a telephone set directly to the wall jack and check for a dial tone. If no dial tone is heard, the telephone line is not working. Contact the telephone company.
Modem will not connect to another modem.	• Check the connections between the modem and the computer, and the modem and the telephone line. • Make sure the telephone jack is operational as described above. • The telephone line may be in use at a different extension. • Perhaps the number you have called does not reach a modem, or the remote modem may not be set up to respond.
No response when you type in AT commands	• There may be a conflicting port address. Re-configure the modem's COM port address (INTERNAL MODEL ONLY).

SYMPTOM	POSSIBLE REMEDY
No response when you type in AT commands (contd)	• Verify that the communication software is set to the same communications port where your modem is attached (e.g., COM1, COM2). Check IRQ settings in your software and on the modem. • Check your serial cable connection (**EXTERNAL MODEL ONLY**). • Try typing AT&F to reset the modem to its factory defaults. • Move the modem to another serial port (***power down the host computer first***). If the modem works after being moved, it's likely the problem is not with the modem.
AT commands not visible.	• Make sure the echo command is set to ON. Change to echo with the ATE command.
After data connection is established, data is displayed as garbled characters.	• Make sure the local (yours) and remote modem configurations are compatible. • Turn off your modem (**EXTERNAL**), exit, and re-run your communication software. • Verify that both modems are operating with the same settings, speed, data, parity, and stop bits. • The software may not be set for correct terminal emulation. Configure software to correct type. ANSI terminal emulation is most commonly used.

SYMPTOM	POSSIBLE REMEDY
Garbled characters (contd)	• Power down your system (INTERNAL) and re-run your communications software. Check software settings. • Exit the communications program and restart it.
The modem does not answer an incoming call.	• You may not have enabled auto-answer. Use your software to enable this function. • If you have an answering machine, it may be answering before the modem can. Turn the answering machine off, or, use the software to set auto-answer to respond in fewer rings than the answering machine. • The call may be originating from a telephone instead of from another modem.
Modem disconnects while on-line.	• Make sure the modem is sent an ATS0=1 command. • Check for any loose connections. • Re-try the connection by dialing the number several times. You may be experiencing line interference. • An incoming call may have broken the connection if a call-waiting feature was enabled. Disable call-waiting and try again.

SYMPTOM	POSSIBLE REMEDY
My software does not support a speed of 14.4Kbps.	• 14.4Kbps refers to modem to modem speed. Select 19.2Kbps (or faster if your hardware supports it) for computer to modem speed.
I am having trouble getting my init string to work.	• Init strings are primarily personal preferences. Use the most basic one that can get the job done. See Installation Hints, page 8.
My 2400bps (or other modem) worked with my system but the Boca modem does not.	• Review earlier suggestions.
I need the modem to connect at a certain speed.	• Send an AT&Q6N0S37=n where n= 9 for 9600, 6 for 2400, 5 for 1200, 1 for 300bps.

SYMPTOM	POSSIBLE REMEDY
Connection Errors.	• Try connecting at a lower speed (e.g., 9600 or 2400bps). • Turn off error correction/compression with an AT&Q6 command. • Noisy/poor line conditions may prohibit connection. Have your phone company test your lines. • Verify that the modem at the other end is up to date and compliant with current CCITT and Bell standards.
Problem Connecting to On-line subscription services.	• Some on-line services require that your modem be configured to run with error correction and data compression turned **OFF**. The easiest way to accomplish this is by using the command **AT&Q6** and setting the communication software to the correct baud rate for the service you are calling (e.g., 2400, 9600bps). If you still have problems connecting, try forcing the modem to connect up at the slower speed with the commands AT&Q6N0S37=**6** for 2400 baud, and AT&Q6N0S37=**9** for 9600 baud services.
Download terminates abnormally.	• Make sure the AT&R1 is set in your active profile.

Appendix A: Command/Protocol Reference

In most cases, your communications software will set and control the operation of your modem. Following is a brief survey of the most commonly used Hayes-compatible AT commands for use with your modem. In addition, we've also provided information on extended AT command sets, S-Registers, and commands and registers for high-level protocols such as MNP, V.42/V.42bis, and V.32/V.32bis.

It will rarely be necessary to use 'AT' commands and S-Registers in command mode (i.e., the DOS prompt). We include them here for more advanced users who may prefer command mode operation, or require special settings.

Hayes-compatible commands consist of a basic command set and an extended command set. The basic set involves functions such as dialing a number, or putting the modem on-hook (i.e., replacing the telephone handset).

Extended commands allow more sophisticated control of the modem such as transmission speed, or initiating high-level functions like data compression or error correction. These functions are defined and controlled by the available protocols mentioned above. A protocol is a set of standards by which data communications operate.

Every AT command includes an "AT" prefix, followed immediately by the command and, in many cases, additional parameters. Multiple commands can be entered at the same time from the DOS prompt.

AT Command[parameter]AT Command[parameter] ...
PRESS ENTER

Example: ATH or ATH0 tells the modem to disconnect

Extended commands were developed to provide greater functionality and control over modem operations. Their format is the same as the basic command except that an additional parameter is required following the AT prefix and before the numerical parameter. This additional parameter comes in three different forms:

the *ampersand* (&) character:	extended AT command
the *backslash* (\) character:	extended AT command for MNP
the *percent* (%) character:	extended AT command for V.42/V.42bis

Examples: **AT&V** tells the modem to display (view) its current configuration and user profile (providing the modem has non-volatile RAM, meaning it can store limited amounts of information when power is off).

AT\J1 tells the computer to adjust its speed to match line speed when a connection is established.

AT%E1 tells the modem to monitor line quality and request a "retrain" (adjustment) to the connection.

S-Registers

Modem command "language" also employs a set of indicators or registers, which are various numerical values all with a standard "S" prefix, hence S-Registers. To a large extent, the values defined in the S-Registers regulate the operation of the modem and the function of some commands in the AT command set.

Example: S-Register 6, or S6=n, defines the length of time the modem will wait for a dial tone. In this case the acceptable range is 3-6 (in seconds) with a default value of 5. With S6=3, the modem will wait three seconds for a dial tone when going off-hook before dialing the first digit of its telephone number.

Data Communication Protocols

This can be more than a little confusing. These protocols represent various domestic and international standards which enhance modem performance and reliability. The protocols are activated and controlled by a variety of extended AT commands and S-Registers.

MNP stands for Microcom Networking Protocol and is a protocol developed by Microcom for full-duplex, error-free communications. This protocol detects and corrects errors which can result from telephone line noise and other signal distortions. There are several classes of MNP operation also referred to as service classes. Class 5 maximizes data transfer rate and provides compression which can significantly increase data throughput.

The "V-Dot" standards are more numerous, but have a single origin: the Consulting Committee for International and Telephone and Telegraph (or CCITT). Some of the lower-level standards such as V.21 and V.22 have "domestic" equivalents as developed by the former Bell System, also referred to as Bell standards. The "V.Dot" standards may be summarized as shown on the following page.

V.21 The CCITT standard for 300bps communications. Domestic modems follow the Bell 103 standard, but V.21 can accept international calls at 300bps.

V.22 The CCITT standard for 1200bps communications. The domestic equivalent is the Bell 212A standard.

V.22bis The CCITT standard for 2400bps.

V.23 CCITT for 1200bps with a 75bps back channel. This is mostly used in Europe and South America.

V.32 CCITT standard for 9600bps and 4800bps communications.

V.32bis CCITT standard for an extensive range of high-speed modems operating at 14,400bps, 12Kbps, 9600bps, 7200bps, and 4800bps.

V.42 CCITT standard for detection and negotiation for LAPM (Link Access Procedure for Modems) error control. V.42 will also support MNP levels 2-4.

V.42bis An extension of V.42 specifying the data compression protocol for use with V.42.

Appendix B: Hardware Diagnostics

The 14.4Kbps modem includes several tests which evaluate the operation of the modem, its connection to the local DTE, and the communications link between the local and remote modems. Use of these tests requires setup of internal registers and may also require the use of two modems and a central office line simulator. **A thorough knowledge of modem operation and registers is needed for their use and should not be undertaken lightly.**

Local Analog Loopback Test

This test verifies the path between the local modem and the PC.

1. Set the DTE speed from 1200 to 14,400 bits per second. If the speed is less than 1200 or greater than 14,400 the test **WILL NOT** operate and a result code of ERROR will be generated if any tests are attempted.

2. Make sure the modem is in command mode (no connection made).

3. Issue an AT&Q0 command to the modem. This sets the modem to the direct mode.

4. Set the timer register (S18) for desired test time (in seconds). Example: "ATS18=10" provides for a 10 second test.

5. To begin the test, type AT&T1 [ENTER]. The modem should respond with a CONNECT message.

6. After the number of seconds specified in S18, the modem will terminate the test and respond with "OK".

Local Analog Loopback Test with Self-Test

This test verifies the integrity of the local modem's transmit and receive circuits.

1. Set the DTE speed from 1200 to 14,400 bits per second. If the speed is less than 1200 or greater than 14,400 the test **WILL NOT** operate and a result code of ERROR will be generated if any of the tests are attempted.

2. Make sure the modem is in command mode (no connection made).

3. Issue an AT&Q0 command to the modem. This sets the modem to the direct mode.

4. Set timer register (S18) for desired test time (in seconds). Example: "ATS18=10" provides for a 10 second test.

5. To begin, type AT&T8 [ENTER]. The modem responds with OK.

6. After the number of seconds specified in S18, the modem should respond with 000 (meaning 0 errors were found during the self test).

Remote Digital Loopback Test

1. Set the DTE speed from 1200 to 14,400 Bits per second. If the speed is less than 1200 or greater than 14,400 the test **WILL NOT** operate and a result code of ERROR will be generated if the test is attempted.

The baud rate is also limited to the highest baud rate supported by the telephone line (14,400 is possible if the telephone line is without distortion and noise free). If the telephone line has problems, bring the baud rate down to 9600 or 2400. If the line quality is too poor, use a line simulator to run this test.

2. Issue an AT&Q0 command to the local modem. This sets the modem to the direct mode.

3. Issue an AT&Q0 command to the remote modem, also setting it to the direct mode.

4. Issue an AT&T4 to the remote modem. This instructs the remote modem to grant a request for a remote digital loop back test.

5. Issue an ATS0=1 to the remote modem which allows it to auto-answer the incoming call.

6. Set the timer register (S18) of the local modem for desired test time (in seconds). Example: "ATS18=10" provides for a 10 second test.

7. Issue a dial command to the local modem to instruct it to call the remote modem. Wait until the two modems have established a connection.

8. Type the escape sequence +++ to revert to command mode. The modem will respond with OK.

9. To start the test, type AT&T6 [ENTER]. The modem will return a CONNECT response if the loopback data link has been successfully completed, and an ERROR response if the link has failed. If a CONNECT response was received, key in a text message and it will echo on the screen.

Remote Digital Loopback Test with Self-test

1. Set the DTE speed from 1200 to 14,400 bits per second. If the speed is less than 1200 or greater than 14,400 the test **WILL NOT** operate and a result code of ERROR will be generated if the test is attempted.

   The baud rate is also limited to the highest baud rate supported by the telephone line (14,400 is possible if the telephone line is without distortion and noise free). If the telephone line has problems, bring the baud rate down to 9600 or 2400. If the line quality is too poor, use a line simulator to run this test.

2. Issue an AT&Q0 command to the local modem. This sets the modem to the direct mode.

3. Issue an AT&Q0 command to the remote modem, also setting it to the direct mode.

4. Issue an AT&T4 to the remote modem. This instructs the remote modem to grant a request for a remote digital loop-back test with self test.

5. Issue an ATS0=1 to allow the remote modem to auto-answer the incoming call.

6. Set timer register (S18) of the local modem for desired test time (in seconds). Example: "ATS18=10" provides for a 10 second test.

7. Issue a dial command to the local modem to instruct it to call the remote modem. Wait until the two modems have established a connection.

8. Type the escape sequence (+++) to revert to the command mode. The modem will respond with OK.

9. Type AT&T7 [ENTER] to initiate the remote digital loopback test. The local modem will send a test pattern to the remote modem. This pattern will not be visible on the screen.

10. The modem will then send a three-digit value, indicating the number of errors detected during testing. If the result is 000, no errors were found.

Appendix C: Technical Specifications

Modem Data Rate: 14.4K, 12K, 9600, 7200, 4800, 2400, 1200, or 300bps

Fax Data Rate: 14.4K, 9600, 7200, 4800, 2400bps.

Compatibility:

Modem Modulation Protocols

CCITT: CCITT: V.32bis, V.32, V.42bis, V.42, V.22 (2400bps) , V.21 (1200bps)

Bell: Bell 212A (1200bps), Bell 103 (300bps)

Fax Modulation Protocols

V.29 (9600/7200bps) transmit
V.27 ter (4800/2400bps) transmit and receive
V.21 channel 2 (300bps) transmit and receive

V.42/MNP2-4 and V.42bis/MNP5 support

LED Status Indicators: (EXTERNAL) **TM, AA, HS, OH, SD, RD, TR, CD**

Diagnostics:
- Local/remote digital and analog loopback.
- Automatic power-on self-test.

Physical and Electrical Characteristics
- Size: **EXTERNAL**: 7 1/4 x 5 3/8 x 1 1/4
  INTERNAL: 4 1/4 x 4 1/8
- Power: 500 mA@ 5V (internal); 115 @100mA (external)
- 2 RJ-11 modular phone connectors.
- Serial cable

Appendix D: Compliance Information

FCC Statement:

"This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.
(2) This device must accept any interference received including interference that may cause undesired operation.

THIS UNIT COMPLIES WITH FCC PART 68 AS OF DATE OF MANUFACTURE.

This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antennae.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to insure compliance.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment."

Notification to the Telephone Company

Notification to the telephone company is no longer required prior to connecting the registered equipment but upon request from the telephone company the user shall tell the telephone company which line the equipment is connected to as well as the registration number and the ringer equivalence of the registered protective circuitry. In most, but not all areas, the sum of all RENs should be 5.0 or less. The FCC Registration number and Ringer Equivalence number are printed on the main chip in the center of the internal modem board, or on the underside of the external modem.

Malfunction of the Equipment

In the event that the MODEM should fail to operate properly, the customer shall disconnect the equipment from the telephone line to determine if it is the customer's equipment which is not working properly, or if the problem is with the MODEM, the user shall discontinue use until it is repaired. In the event service is needed the user should contact the vendor from whom you purchased the MODEM.

Telephone Connection Requirements

Except for telephone company-provided ringers, all connections to the telephone network shall be made through standard plugs and standard telephone company-provided jacks, or equivalent, in such a manner as to allow for easy and immediate disconnection of the terminal equipment. Standard jacks shall also be arranged that, if the plug connected thereto is withdrawn, no interference to the operation of the equipment at the customer's premises which remains connected to the telephone network, shall occur by reason of such withdrawal.

Incidence of Harm

Should terminal equipment or protective circuitry cause harm to the telephone network, the telephone company shall, where practical, notify the customer that temporary discontinuance of service may be required; however, where prior notices are not practical, the telephone company may temporarily discontinue service if such action is deemed reasonable in the circumstances. In the case of such temporary discontinuance, the telephone company shall promptly notify customers and will be given the right to bring a complaint to the FCC if they feel the disconnection is not warranted.

Changes in Telephone Company Equipment or Facilities

The telephone company may make changes in its communications facilities, equipment, operations, or procedures, where such action is reasonably required and proper in its business. Should any such changes render the customer's terminal equipment incompatible with the telephone company facilities, the customer shall be given adequate notice to make modifications to maintain uninterrupted service.

General

The FCC prohibits customer-provided terminal equipment be connected to party lines or to be used in conjunction with coin telephone service.

Installation

The MODEM is equipped with a USOC RJ-11 standard miniature modular jack and is designed to plug directly into a modular jack.

DOC Compliance Statement (Canada)

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunction, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure, for their own protection, that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the load numbers of all the devices does not exceed 100. The Load number appears on the underside of the 14.4Kbps Modem.

Appendix E: Warranty Information

Limited Warranty

Boca Research, Inc. (BRI) warrants to the original buyer of this BRI product that the hardware is free of defects in materials and workmanship for a period of five years from the date of purchase from BRI or an authorized dealer. Should the MODEM fail to be in good working order at any time during the five-year period, BRI, will at its option, repair or replace this product at no additional charge, provided the part or product has not been abused, misused, repaired, or modified.

MODEMs which require the Limited Warranty service during the warranty period should be delivered to the nearest authorized dealer or sent to BRI at the address in Appendix F: Servicing Your Boca Product with proof of purchase the Return Merchandise Authorization (RMA) number provided by BRI Technical Support. Refer to Appendix F. Replacement parts or complete MODEMs will be furnished on an exchange basis only. Replaced parts and/or MODEMs become the property of BRI.

If the returned MODEM is sent by mail, the purchaser agrees to prepay shipping charges, insure the MODEM or assume the risk of loss or damage which may occur in transit, and to use a shipping container equivalent to the original packaging. ALL EXPRESS AND IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE FOR THE MODEM ARE LIMITED IN DURATION TO THE ABOVE FIVE-YEAR PERIOD. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

UNDER NO CIRCUMSTANCES WILL BOCA RESEARCH, INC. BE LIABLE IN ANY WAY TO ANY PURCHASER FOR DAMAGES, LOST REVENUE, LOST WAGES, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE MODEM. Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitations may not apply to you.

Boca Research, Inc. reserves the right to make modifications in both hardware and software without prior notification.

This warranty gives you specific legal rights, and you have other rights which may vary from state to state.

Appendix F: Servicing Your Boca Product

If your 14.4Kbps Modem requires service, first contact the authorized dealer from whom you purchased the modem. If the dealer is unable to assist you, and you must contact Boca Research, Inc., please follow the instructions below.

Our electronic BBS is available 24 hours a day at (407) 241-1601 and will support data transmission speeds up to 14.4Kbps with settings of N, 8, 1. Once your modem is functional, the BBS may be helpful (especially during off hours) if you have a question about product settings, or if you wish to download special software or utilities. You may also fax us at (407) 997-0918.

If the Troubleshooting section (section Four) did not resolve your problem, you may call our technical support staff for assistance. If you haven't referred to the Troubleshooting section, do so now.

NOTE: CALLING TECHNICAL SUPPORT WITHOUT COMPLETE AND ACCURATE INFORMATION CONCERNING YOUR PROBLEM MAY BE BOTH TIME-CONSUMING AND FRUSTRATING FOR YOU.

---

1. When calling Boca Research Technical Support, have the following information available:

   - **Board or external unit name and part number**
   - **Computer manufacturer**
   - **Computer Model**
   - **Peripherals in system**
   - **Operating system and version**

   If you suspect a problem with a specific program or software package, make note of the name, version or release number, and manufacturer of the software.

2. Call our Technical Support Department between the hours of 8:00 a.m. and 7:00 p.m. EST Monday through Friday at (407) 241-8088. A technician will be available to discuss the problem(s) you are experiencing. You may also contact us via fax at (407) 997-0918.

If factory service is required, you will be given a Return Merchandise Authorization (RMA) number. Please place this number on the outside of the package when you return the item(s) for service and reference it on any correspondence included in the package. Boca Research, Inc. will return any product which is not accompanied by an RMA number.

3. If the product is covered under the five-year Boca Research, Inc. Limited Warranty there will be no charge for parts and labor required to make the repair. Be sure to include your receipt as proof of purchase for all warranty repairs.

4. If the product is not covered under the five-year Boca Research, Inc. Limited Warranty there will be a fixed charge of $75 for each item returned.

5. Certain parts will not be covered under the Boca Research, Inc. Limited Warranty. Dealer installed parts are warranted by the dealer. Parts which you have installed yourself are covered only by the supplier's warranties. In these cases, Boca Research, Inc. can identify which parts are defective, but will not replace such parts until specific written authorization is received from you. The cost of parts and labor involved in making such repairs will be billed to you C.O.D.

6. When sending the 14.4Kbps Modem to Boca Research, Inc. for repairs, please be sure to include:

   - **a brief but accurate description of the problem**
   - **the 14.4Kbps Modem**
   - **RJ-11 telephone cable**
   - **AC adapter with cord (external model only)**
   - **this installation manual**
   - **communication software and manual**
   - **your return street address (for UPS purposes)**
   - **phone number**
   - **the RMA number mentioned above**

Products returned to Boca Research without manuals and diskettes will be replaced without manuals and diskettes. Package the product securely in a container equivalent to the original packaging, and insure the package to protect against loss or damage during transit. Shipping charges must be prepaid; C.O.D. shipments will not be accepted. Please use the address below for all correspondence:

Boca Research, Inc.
RMA Department - RMA #_____
6413 Congress Avenue / Suite 130
Boca Raton, FL 33487-2841

7. If the repairs performed on your MODEM were covered by the warranty, Boca Research, Inc. will return it prepaid via UPS. If you prefer Federal Express delivery, please provide your Federal Express account number. Shipping costs for items not covered by the warranty will be billed C.O.D.

Copyright

©1993 Boca Research, Inc. All rights reserved. No reproduction of this document in any form is allowed without permission in writing from Boca Research, Inc. Boca Research is not liable for any damage resulting from technical or editorial errors or omissions contained in this document. The information in this manual is subject to change without notice. Revisions to the product(s) in this manual may occur at any time without notice.

Trademarks

All Boca Research products are trademarks of Boca Research, Inc. All other references to computer systems, software, and peripherals use trademarks owned by their respective manufacturers.

Publication Date: July, 1993
Printed in the U.S.A.

M144IEW.PM4

AT Command Quick Reference

Command	What It's For	Default
A/	Re-execute command	none
ATA	Answer	none
ATBn	Select CCITT or Bell Mode	1 (BELL) 0 (CCITT)
ATCn	Return OK Message	1
ATD	Dial	none
ATEn	Command Echo	1
ATFn	Select Auto-Detect	1
ATHn	Switch-Hook Control	0
ATIn	Report Product Code	0
ATKn	Buffer Control	none
ATLn	Speaker Volume	1
ATMn	Speaker Control	1
ATNn	Automode Detection	1
ATOn	Go On-Line	0
ATP	Select Pulse Dialing	none
ATQn	Result Code Display	0
ATSn	Select S-Register	none
ATSn?	Reading S-Registers	none
ATSn=x	Writing to S-Registers	none
ATT	Select DTMF Dialing	none
ATVn	Result Code Form (message control)	1
ATWn	Negotiation Progress Reporting	0
ATXn	Extended Result Codes	4
ATYn	Control Long Space Disconnect	0
ATZn	Reset/recall stored profile	0
+++	Escape Characters (switch from on-line to command mode).	none
?	Displays contents of last addressed S-Register	none
AT&Cn	DCD (Data Carrier Detect) Option	1
AT&Dn	DTR (Data Terminal Ready) Option	2
AT&F	Restore Factory Configuration	none
AT&Gn	Set Guard Tone	0
AT&Jn	Telephone Jack Selection	0
AT&Kn	DTE/Modem Flow Control	3
AT&Mn	Communication Mode Operation	0
AT&Pn	Dial Pulse Ratio	0
AT&Qn	Communication Mode	5
AT&Rn	RTS/CTS Option	1
AT&Sn	DSR (Data Set Ready) Option	0
AT&Tn	Test and Diagnostic	4
AT&V	View Current Configuration/User Profiles	0
AT&Wn	Store Active Profile	0
AT&Yn	Select Stored Profile on power-up	0
AT&Zn=x	Store Telephone Number	none

AT Command Quick Reference (contd)

Command	What It's For	Default
AT%Cn	Compression Control	1
AT%En	Auto-retrain Control	1
AT%Ln	Return Received Line Signal Level	none
AT%Qn	Report the Line Signal Quality	none

S-Register Quick Reference

Command	What It's For	Default
S0	Number of Rings till Auto-Answer	0 *
S1	Ring Counter	0
S2	Escape Character	43 *
S3	Carriage Return Character	13
S4	Line feed Character	10
S5	Back Space Character	8
S6	Wait Time for Dial Tone	2 *
S7	Wait for Carrier	50 *
S8	Pause Time for Dial Delay	2 *
S9	Carrier Detect Response Time	6 *
S10	Carrier Loss Disconnect Time	14 *
S11	DTMF Tone Duration	95
S12	Escape Code Guard Time	50 *
S14	Bit-Mapped Options	138 (8Ah)
S16	Bit-Mapped Test Options	0
S18	Test Timer	0 *
S21	Bit-Mapped Options	4 (04h)
S22	Bit-Mapped Options	117 (75h)
S23	Bit-Mapped Options	55 (37h)
S24	Sleep Inactivity Timer	0
S25	Detect DTR Change	5 *
S26	RTS to CTS Delay Interval	1 *
S27	Bit-Mapped Options	73 (49h)
S28	Bit-Mapped Options	0
S29	Flash Dial Modifier Time	0
S30	Disconnect Inactivity Timer	0
S31	Bit-Mapped Options	2*
S32	XON Character	17 (11h)
S33	XOFF Character	19 (13h)
S36	LAPM Failure Control	7*
S38	Delay Before Forced Hangup	20*
S39	Flow Control	3

S-Register Quick Reference (contd)

Command	What It's For	Default
S40	Bit-Mapped Options	105 (69h)
S41	Bit-Mapped Options	3
S46	Data Compression Control	138
S48	V.42 Negotiation Control	7
S80	Soft-Switch Functions	0
S82	LAPM Break Control	128 (40h)
S86	Call Failure Reason Code	none
S91	PSTN Transmit Attenuation Level	10
S92	Fax Transmit Attenuation Level	10
S95	Result Code Messages Control	0*
S202	Remote Acces Escape Character	170

* Value saved in NVRAM.

V.42, MNP AT Command Quick Reference

Command	What It's For	Default
\An	MNP block size	3 *
\Bn	Transmit Break	none*
\Cn	Set auto-reliable buffer	0 *
\Gn	Set modem port flow control	0 *
\Jn	Bps rate adjust control	0 *
\Kn	Set break control	5 *
\Nn	Set operating mode	3 *
\O	Originate reliable link	none
\Qn	Set serial port flow control	3 *
\Tn	Set inactivity timer	0 *
\U	Accept auto-reliable link	none
\Vn	Modify result code form	2 *
\Xn	Set XON/XOFF pass-through	0 *
\Y	Switch to reliable mode	none
\Z	Switch to normal mode	none
-Jn	Set V.42 detect phase	1 *
"Hn	V.42bis compression control	3 *
"On	V.42bis string length	16

* Value saved in NVRAM

Note: Defaults are subject to change. Bit-mapped registers have equivalent AT letter commands that are are more easily manipulated.

Basic Response Codes (\V1)

Numeric	Verbose Code
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	CONNECT 1200
6	NO DIAL TONE
7	BUSY
8	NO ANSWER
10	CONNECT 2400
+F4	+FCERROR

Modified Response Codes (\V1)

Numeric	Verbose Code
22	Connect 300/REL
24	Connect 1200/REL
25	Connect 2400/REL

V.42 Extended Response Codes (\V2)

Numeric Code	Verbose Code
32	CONNECT 300/REL-MNP
34	CONNECT 1200/REL-MNP
35	CONNECT 2400/REL-MNP
42	CONNECT 300/REL-MNP 5
44	CONNECT 1200/REL-MNP 5
45	CONNECT 2400/REL-MNP 5
52	CONNECT 300/REL-LAPM
54	CONNECT 1200/REL-LAPM
55	CONNECT 2400/REL-LAPM
62	CONNECT 300/REL-LAPM V.42bis
64	CONNECT 1200/REL-LAPM V.42bis
65	CONNECT 2400/REL-LAPM V.42bis

Dial Modifiers

Dial Modifier	Options	Description
L	none	**Redial**. Instructs the Modem to re-dial the last valid telephone number
P	none	**Pulse (rotary) dial.** Instructs the modem to dial the phone using pulse (rotary) dialing at a fixed rate or 10 pulses per second.
S=n	none	**Dial Stored Number**. Follows the dial command string, causing the modem to dial a telephone number previously stored using the AT&Zn command (where n=0-19).
T	none	**Touch tone (DTMF) dialing**. Instructs the modem to dial the phone using touch tone dialing.
W	1-255 sec.	**Wait for dial tone**. Instructs the modem to wait a specified period of time before processing the next command. The default time is 50 seconds. If the modem does not detect a dial tone in the specified period of time, it will hang up. The message NO DIAL TONE will be displayed.

Dial Modifier	Options	Description
,	0-255 sec.	**Pause**. Instructs the modem to pause for a specified period of time before processing the next command. The default time is two seconds. This can be modified by setting the S8 register.
@	none	**Wait for silence**. Instructs the modem to wait a specific amount of time for one or more rings, followed by a 5 second. pause. The next command on the line will then be executed. You can use this command to establish a connection with a system that does not have a dial tone.
!	none	**Initiate hook flash**. Causes the modem to go on-hook for a half second.
;	none	**Return to command state after dialing**. Instructs the modem to return to the command state at the end of the command line. It can be used for originating voice calls and must be placed at the end of the dial string.

Glossary

A

algorithm. A formula or procedure which employs various methods defining how data is to be used to give a prescribed result.

analog signals. Signals which can vary over a continuous range (e.g., the human voice over conventional telephone lines). Analog circuitry is more subject to distortion and noise, but it is more capable of handling complex signals than are digital signals which can have only discrete values.

ARQ. Automatic ReQuest for retransmission. A type of communications link where the receiver asks the transmitter to re-send a block of data when errors are detected.

ANSI. American National Standards Institute. A non-profit, private industry association which governs most USA-standards setting agencies.

ASCII. Acronym for American Standard Code for Information Interchange. ASCII is an ANSI character set. The standard ASCII character set consists of 128 decimal numbers (0-127) for letters of the alphabet, numerals, punctuation marks, and common special characters. The extended ASCII character set extends to 255 characters and contains special mathematical, graphics, and foreign characters.

asynchronous communications. A method of transmission in which one character is sent one bit at a time; also referred to as serial transmission.

B

Bell standards. Refers to the U. S. modulation protocol standards developed by the former AT&T Bell Systems such as Bell 103 (300bps transmission) and Bell 212A (1200bps transmission).

bit-mapped registers. An S-register which contains multiple bit-oriented values. Example: the value of S22 is the sum of the bit values which you select (bits 0-1: speaker volume/value: 0-3; bits 2-3: speaker control/value: 0-3; bits 4-6: limit result codes/value: 0, 4-6, 7).

blind dialing. An automated process whereby the modem goes off-hook and dials without waiting for a dial tone. This is prohibited in many countries.

block transfer control. Determines whether or not the modem uses block or stream mode during an MNP connection. In stream mode, MNP sends data frames in varying length. Block mode sends fixed data frames of 256 characters and is selected with the MNP-based \L command.

break handling. Determines how the modem responds when a BREAK signal is received from either the DTE (Data Terminal Equipment or computer/terminal) or the remote modem. This is controlled by the MNP-based AT extended command \K. A break signal is represented on the communications line by a steady space signal for a significant length of time. Break signals may be activated from the keyboard by pressing the BREAK key or the control (CTRL) and C keys.

C

CCITT. Consultative Committee for International Telephone and Telegraph. This advisory organization is part of the ITU (International Telecommunication Union) which is an agency of the United Nations.

command mode. The modem is in command mode when it is turned on or reset, when it loses its connection to a remote modem, when it is in on-line mode, or when escape characters (+++) are typed. To transmit data, the modem must be in data mode. The modem does not transmit data when in command mode.

communications protocol. A set of procedures which controls how a data communications network operates.

D

DCD. Data Carrier Detect. Indicates to the terminal device that the modem is receiving a valid carrier signal from a remote modem. The carrier is a tone at a specified frequency.

DCE. Data Communications Equipment. The local and/or remote modem. A DCE is usually connected to a DTE.

DTE. Data Terminal Equipment. The computer or terminal, either local (yours), or the remote (the one you're communicating with). A DTE is usually connected to a DCE.

DTR. Data Terminal Ready. The computer issues this signal to the attached modem indicating that it is ready to receive data.

data compression. A technique that examines transmitted data for redundancy and replaces strings (groups) of characters with special codes which the receiving modem interprets and restores to its original form. Transmission of compressed data results in shorter connect times and hence cost savings for connect charges. Data compression is sometimes called "source encoding".

data mode. The modem is in data mode when a connection has been established with a remote modem and sends a CONNECT response confirming the connection. User data may then be transmitted or received.

dial modifier. Dial modifiers are special characters appended to the ATD command which instruct the modem how to place a call.

digital signal. A discrete signal which can only take on one of several (usually only two) discrete levels in contrast to analog signals which can take a continuous range of levels.

E

error detection and correction. The transmitting modem attaches a special pattern (called a frame check sequence) calculated according to a prescribed algorithm from user-defined data to the end of a block of data. The receiving modem performs the same algorithm and compares it to the one with the transmitted data. If these match, then the block of data has been received correctly. If not, the block of data is re-transmitted until no errors are detected.

escape sequence. Also referred to as the escape command. This special command is entered as three plus symbols (+++) and places the modem in command mode and interrupts user data transmission, but does not terminate the data connection. This allows the entering of commands while the connection is maintained.

extended AT-command. Extended commands were developed to provide greater functionality and control over modem operations than is available from the basic AT command set.

F

fax mode. The modem is in fax mode when, through use of fax communications software, it can send and receive faxes, print and display fax files, convert files to fax-files, and set certain fax-related features. Note: the modulation protocol used by the modem in fax mode is also different from the usual data mode modulation.

flow control. Compensates for the difference between the rate at which data reaches a device and the rate at which the device processes and transmits. This is controlled by the extended AT command &K. The two common types of flow control are RTS/CTS signaling (a hardware based method, employing an electrical signal) and XON/XOFF (a software-based method using standard ASCII control characters to pause or resume transmission).

full-duplex. Two-way simultaneous transmission between modems, which may occur via a four-wire circuit on a leased line, or with a two-wire connection when the frequency bandwidth is divided into two distinct channels, or when echo cancellation is employed (e.g., Bell 103, 212, and V.22 use frequency division, while V.32 uses echo cancellation).

G

guard tone. Guard tones are used in the United Kingdom and other countries. This requires that the modem transmit an 1800-Hz tone after it sends an answer tone. The guard tone is controlled by the &G command. Guard tones are not used in the U.S.A.

H

half-duplex. Signal flow in both directions, but only one way at a time with each modem alternating between send and receive.

Hayes-compatible. Hayes Microcomputer Products, Inc. developed the AT command set which has become a de facto industry standard. Hayes commands are always initiated with an AT (attention code) prefix.

hook flash. The dial modifier "!" causes the modem to go on-hook (hang-up) for one-half second. Also controlled by the ATH command.

L

LAPM. Link Access Protocol Modem. A V.42 ARQ type of error correction protocol which is controlled by S-Register 46, where LAPM may be activated with or without V.42bis data compression.

leased line. Also referred to as a private line. A leased line is obtained from a communications company (carrier) to provide a transmission medium between two points. The line consists of a permanent dedicated circuit between two points, or to set of previously arranged points. The cost of the line is usually based on the distance between locations. This is in contrast to switched or dial-up lines, which can be connected to any point on the network.

line modulation. The means by which a carrier is varied to represent a signal carrying information. In a modem, the user's digital data is used to modulate the modem's transmitter's carrier or carrier to allow the digital signal to be carried over analog facilities.

long space disconnect. Determines whether or not modem disconnects when it receives a continuous break from a remote modem. Controlled by the ATY command.

loopback tests. There are four types of loopback tests which are as follows: (1) the local digital loopback tests the operation of the DTE, including whether or not data is leaving the terminal or computer port; (2) the local analog loopback tests the digital and analog circuits of the modem; (3) the remote digital loopback checks the operating condition of the line and remote modem; (4) the remote analog loopback tests the line to the remote modem.

M

MNP. Microcom Networking Protocol. A series of data communications protocols developed by Microcom for full-duplex, error-free communications.

make/break ratio. The &P command controls the ratio of the off-hook (make) to on-hook (break) interval used by the modem when it pulse dials. &P0 selects a 39%/61% make/break ratio for use in the U.S. &P1 selects a 33%/67% make/break ratio for use in the United Kingdom and Hong Kong. The &P command is NOT allowed in Germany.

modulation handshake. Also referred to as Automode Enable and is controlled by the ATN command. This determines whether or not the modem must connect at a particular speed, or allow connection at any speed supported by both modems.

N

negotiation fallback. Controlled by S-Register 36 as part of the V.42 protocol. Setting this register indicates what action to take when a desired connection cannot be made (e.g., hang-up, direct mode connect, normal mode connect).

non-volatile RAM. Also NVRAM. Random access memory whose data is retained when power is turned off. This is especially useful for modems to store user-defined default configuration settings and frequently used telephone numbers. This information would be loaded into modem RAM at power-up.

O

on-line state. Same as data mode. To transmit or receive data, the modem must be in the on-line state. When placing a call, the modem is put on-line with the dial command.

P

PBX. Private Branch Exchange. A telephone switch at a customer site.

pulse dialing. Also referred to as rotary dialing, i.e., dialing with the older-style rotary dial wheel. The dial modifier ATP sets the modem to pulse dialing, which is the default method as opposed to tone dialing (push-button touch-tone) which is enabled with ATT. All telephone exchanges will accept older-style pulse dialing and most exchanges will accept modern tone-dialing. Tone dialing is faster and more reliable since mechanical relays and their inherent failure mechanisms are avoided.

R

result code. A response sent by the modem after executing a command. The response reports the modem's status or the progress of a call and can take the form of either digits (numeric) or words (verbose). Issuing a V1 command enables word responses. A V0 (V-zero) command enables numeric responses. The Q1 command disables their use entirely. Example: "OK" (word), or 0 (numeric) indicates that the modem successfully executed a command.

retrain. An adjustment process performed when one of the modems detects signal distortion or line noise which threaten data integrity.

RTS/CTS. Request to Send/Clear to Send. RTS and CTS are two control signal lines between the modem (DCE) and terminal (DTE) which allow the terminal to control the flow of information. See also flow control.

S

sleep inactivity timer. Determines the length of time the modem operates in normal mode with no activity before entering low-power "sleep" mode.

split-speed direction. Determines which direction (transmit or receive) has the 75bps channel and which has the 1200bps channel, but is only active if the \W command is set to 1. Used with V.23 modulation only.

standard AT-command. The basic AT command set, originated by Hayes Microcomputer Products, Inc.

synchronous clock source. Applies to synchronous modem operations and is set with the &X command. The command specifies the clocking source referred to as the transmit signal element timing. This can be controlled by either the modem or the terminal.

synchronous communications. A method of transmission in which data bits are sent continuously at the same rate under the control of a fixed frequency clock signal.

T

touch-tone dialing. Push-button tone dialing as used on contemporary phone sets. The dial modifier ATT sets the modem to "tone" mode. Tone dialing is faster and more reliable than older-style pulse dialing.

X

XON/XOFF. XON and XOFF are the names of two different control characters. See also flow control.

Acknowledgements

The Complete Modem Reference. Gilbert Held. John Wiley & Sons, Inc. 1991.
Upgrading and Repairing PCs. (Second Edition). Que Corporation. 1992.

Index

A

AC wall socket 13
AT Command Quick Reference 49-50

B

Basic Response Codes 52
Bell standards 33

C

CCITT 33
COM ports 20
Command/Protocol Reference 31-34
Communication Settings 20
Communications Software 16
Compatibility 40
Compliance Information 41-44
Connecting the Phone Line 12, 23
Contents of Your Package (external) 10
Contents of Your Package (internal) 19

D

Data Communication Protocols 33
Data transmission rates 7
DB-25 (25-pin male connector) 11
Dial Modifiers 53
Dial Stored Number 53

E

Echo command 27
Electronic BBS 46
Extended AT command for V.42/V.42bis 32
Extended AT command for MNP 32
Extended AT command sets 31

F

Fax Data Rate 40
Fax Modulation Protocols 40
FCC Requirements 3, 41-44
Features 7

G

Glossary 55-61
Group III send and receive fax capability 7

H

Hardware Diagnostics 35-39
Hayes 'AT' command set 7, 31, 49-50
Hook flash 54
HST Dual Standard Modem 8

I

Initialization (INIT) string **8**
Initiate hook flash **54**
Installation Hints **8**
Internal Installation **19-25**
Interrupt-sharing **20**
IRQ settings **20**

L

LED Status Indicators **40**
Local Analog Loopback Test **35**
Local Analog Loopback Test with Self-Test **36**

M

Microcom Networking Protocol **33**
MNP **33**
Modem Data Rate **40**
Modem Modulation Protocols **40**
Modified Response Codes **52**

N

Non-standard IRQs **21**

O

Operational Requirements **11**
Operational Requirements (external) **11**

P

Pause **54**
phone jack types **3**
Physical and Electrical Characteristics **40**
Preparing the Modem (external) **13**
Pulse (rotary) dial **53**

Q

Quick Start! **4, 5**

R

Remote Digital Loopback Test **36-37**
Remote Digital Loopback Test with Self-test **38-39**
Return Merchandise Authorization **47**
Return to command state **54**
Ringer equivalence number **3**
RJ-11 cable **12, 23**

S

S-Register Quick Reference **50-51**
S-Registers **32**
Servicing Your Boca Product **46-48**
speaker volume control **7**

T

Technical Specifications 40
Telephone Company
Requirements 3

Telephone jacks 3
Testing the Connection
(internal) 25
Testing the Connection
(external) 18
Touch tone (DTMF)
dialing 53
Troubleshooting 26-30
TSR (terminate and stay
resident) program 8, 20

V

"V-Dot" standards 33-34
V.42 Extended Response
Codes (\V2) 52
V.42, MNP AT Command
Quick Reference 51
Voice and data switching 7

W

Wait for dial tone 53
Wait for silence 54
Warranty Information 45

BOCA
RESEARCH INC

Manual Part No. 9144
Rev. 2.0